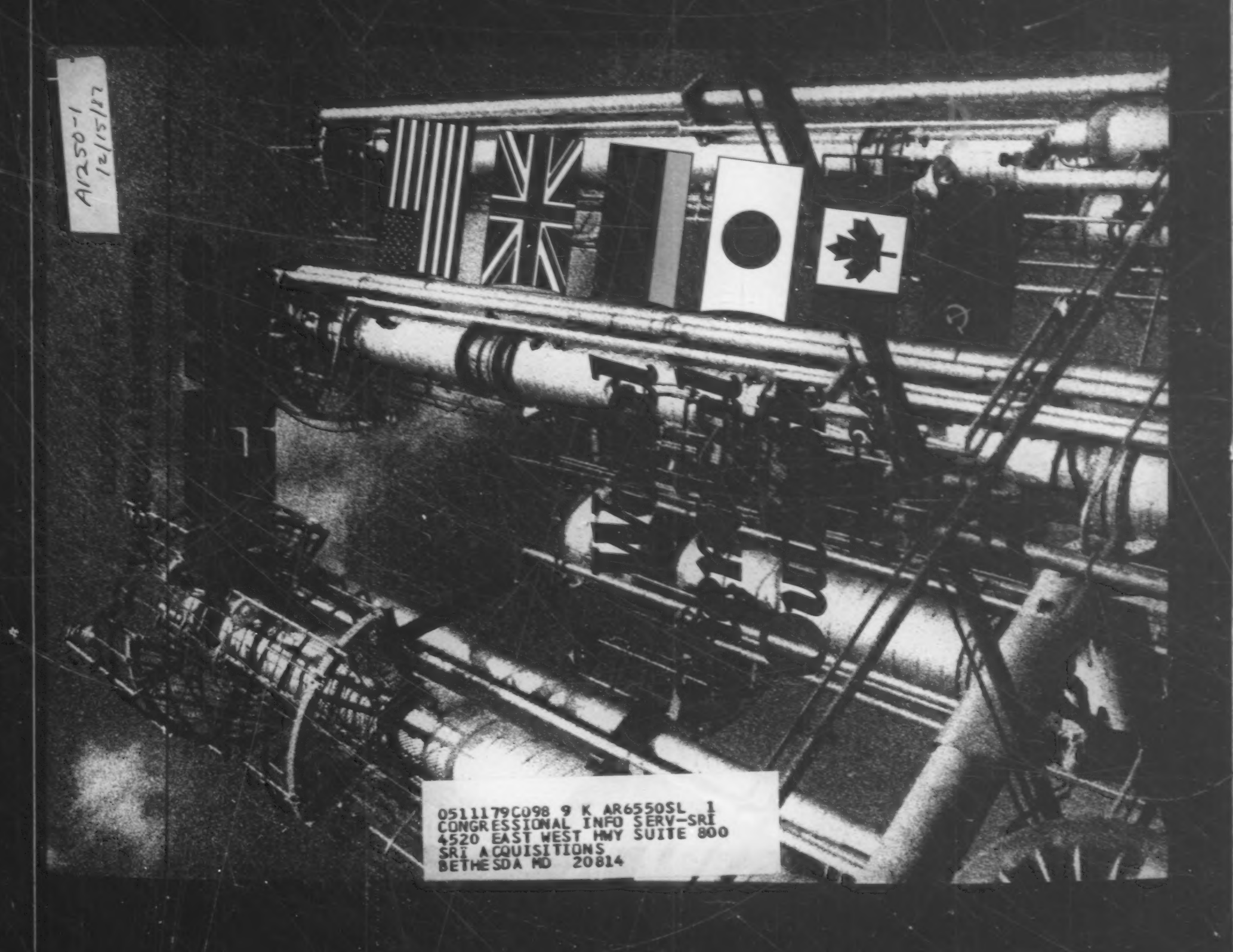
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CHEMICAL & ENGINEERING
NEWS

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DECEMBER 14, 1987

News of the Week

■ **At the recent U.S.-Soviet summit in Washington, D.C., scientists from both countries met in an effort to expand cooperation in scientific and economic areas.** **Page 4**

■ **National Coalition for Science & Technology, a lobby group that focused on the nuts and bolts of issues affecting scientists, closes its doors six years after it was founded.** **Page 5**

■ **ACS Board, meeting in Ohio, votes to set next National Chemistry Day for 1989, reelects Ernest Eliel as chairman, and approves 1988 budget.** **Page 5**

■ **NAS symposium on science of nutrition examines field's current status and attempts to identify future research, training directions.** **Page 6**

■ **For fifth year in a row, plastics industry registers new record highs for plastics sales, production.** **Page 6**

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Business

As demand for polyvinyl chloride exceeds supply, inventories shrink, prices increase, and producers move to expand capacity. **Page 9**

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Chemical & Engineering News

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LETTERS

Chiral recognition system

SIR: We at Illinois were gratified at the coverage given to the work of William Pirkle and his group in the recent article "Progress Made in Synthesizing Enzyme Mimics" (C&EN, Oct. 19, page 30). The article was well written and technically quite accurate. Your readers might be interested to know that the chiral recognition mechanism advanced to account for the deracemization study described in the article has been supported by rather elegant intermolecular nuclear Overhauser effect studies conducted by Thomas C. Pochapsky while he was a graduate student in the Pirkle group. Pochapsky developed the chiral recognition system, which led to the deracemization studies. This work has recently appeared in the *Journal of the American Chemical Society*, **109**, 5975 (1987).

Gary B. Schuster
Professor of Chemistry
University of Illinois, Urbana-Champaign

Environmental chemistry

SIR: The article on "Education for New Technology" (Oct. 26, page 34) was excellent, suggesting as it does that our field needs to expand at the fringes to encompass hot new areas such as materials, solid-state chemistry, and biochemistry. Chemistry is an old and conservative field that has been slow to react to new opportunities.

One fringe area the article did not mention is environmental chemistry. Our department at the University of Maryland has had a very successful graduate program in environmental chemistry for the past 15 years involving both atmospheric and water research. The problems involved in the field are some of the largest issues facing society: e.g., global climate change, destruction of the ozone layer, and the control of toxic wastes.

Although environmental chemistry does not usually involve breakthroughs in the fundamentals of chemistry, it demands highly sophisticated applications of chemistry and other disciplines. Furthermore, environmental chemistry has driven great improvements in our knowledge of elementary chemical reactions, modeling of complex chemical systems, the development of highly sensitive analytical methods, and the application of multivariate statistical methods to chemical problems, a field now called "chemometrics." Although chemistry plays a central role in most environmental problems, academic research and teaching in the field are rarely found in chemistry departments. Instead they are often located in departments such as civil engineering, atmospheric sciences, environmental sciences, or environmental engineering. This is most unfortunate, as the insights of people trained as chemists are usually needed for a thorough understanding of the problems.

Glen E. Gordon
Department of Chemistry and Biochemistry
University of Maryland

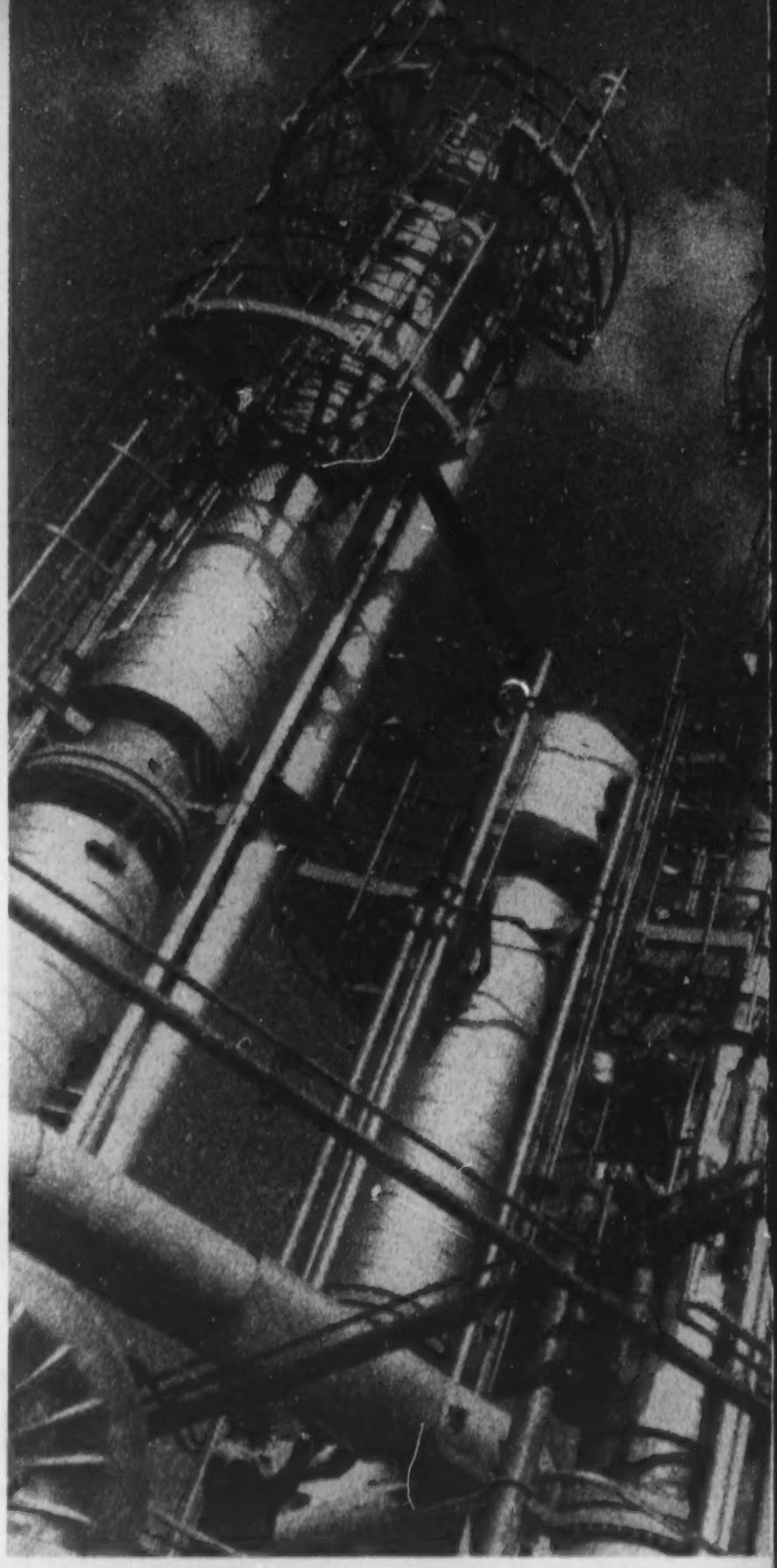
Polyene cyclizations

SIR: This is in regards to your article on polyene cyclizations (C&EN, Oct. 19, page 34). Like many others, I have been inspired by the brilliant chemistry that encompasses the polyene cyclization, developed under the inspiring leadership of William S. Johnson, Stanford University. Their recent observations that cation-stabilizing auxiliary improves the yields of the polyene cyclization reaction [*J. Am. Chem. Soc.*, **109**, 5852 (1987)] have led Johnson's group to speculate on the enzymic mechanism involving biological carbocations as reaction intermediates. A proposal has thus been advanced that the transition state analogs of the biological carbocations should be potent inhibitors of enzyme catalyzed reactions.

It should be heartening for the readers of C&EN to note that in a series of communications, it has already been demonstrated that a biological carbocation can be efficiently mimicked by an ammonium function, including N-oxides [Narula, A. S., Benveniste, P., et al., *J. Am. Chem. Soc.*, **103**, 2408 (1981); *Biochem. Soc. Trans.*, **11**, 537 (1983); *J. Biol. Chem.*, **259**, 15215 (1984); *Lipids*, **21**, 52 (1986)]. These studies have led to the development of some of the most potent inhibitors of plant sterol biosynthesis and squalene-2, 3-epoxy-cyclase.

These studies have been extended by others to devise transition-state analog inhibitors of farnesyl pyrophosphate-squalene synthetase [Poulter, C. D., *J. Am. Chem. Soc.*, **104**, 7376 (1984)] and isopentenyl pyrophosphate isomerase [Abeles, R. H., et al., *J. Am. Chem. Soc.*, **107**, 4078 (1985)]. More recently, a summary of the inhibitors of squalene-2, 3-epoxide cyclase devised by exploiting the above concepts has also appeared [Cattel, L., et al., *Lipids*, **21**, 31 (1986)].

Acharan S. Narula
Duke University Medical Center
Durham, N.C.



What a difference four or five years can make.

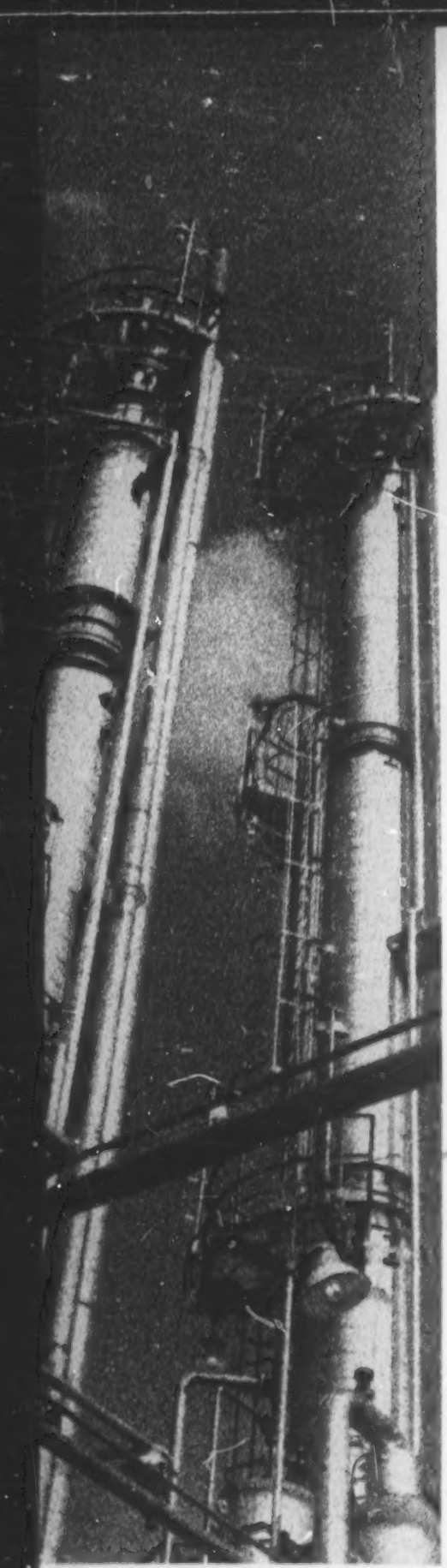
Reporting on the outlook for the world's chemical industry at the end of 1982, "widespread malaise" were the words that C&EN used. "Production of chemicals has been cut back drastically," we reported at that time, and plant capacity is "far in excess of any foreseeable demand. Producers increasingly find themselves strapped financially."

Since then, however, chemical companies throughout the industrialized Western World have inflicted a massive revamping upon themselves. It has not been without pain. Tens of thousands of jobs have been wiped out. Hundreds of millions of dollars worth of operating assets have been jettisoned. Research and investment programs have been radically reshaped.

Demand for chemicals has increased in the past five years. As a result, output of industrial chemicals and synthetic materials in the U.S. this year is more than 40% higher than in 1982. And in the major chemical-producing countries of Western Europe and in Japan, chemical output is up 15 to 30%, as well.

That's hardly exceptional growth, by any means. But with production capacity slashed, in many key product areas plants now are being pushed to their design limits and producers are reaping the rewards—in higher prices, higher productivity, and increased profitability—that stem from a seller's market.

In a relatively slow-growing global economy, next year's harvest may be less bountiful. But the world's chemical industry now seems to have its house in good enough order that it will be able to withstand an economic slump, should it occur, better than it could in the early 1980s.



World Chemical Outlook

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Profits up sharply as producers reap benefits of restructuring

A much slimmed down chemical industry is running many of its plants full out to meet current demand

David M. Kiefer, C&EN Washington

This autumn has witnessed chaotic turmoil in U.S. investment and currency exchange markets. Deep and recalcitrant deficits continue to sorely beset both the federal budget and the U.S. balance of foreign trade. Auto sales are slumping and new housing starts are on a decline. Consumer confidence may be ebbing, and, in the wake of the recent debacle on Wall Street, predictions of impending recession, although still not the consensus among economists, are becoming more common.

So who is crying all the way to the bank? U.S. chemical producers, that's who.

This year, producers of basic industrial chemicals, plastics, and fibers will boost their sales at least 10% to about $90 billion (exclusive of sales of foreign subsidiaries), thanks to increased demand both at home and abroad and to higher selling prices. For the broader chemicals and allied products industry, sales will show a slightly stronger gain of 11 to 12%.

But it is the industry's profitability that really is on a roll. Net income for makers of basic chemicals and synthetic materials will surge 40% or even a bit more in 1987, to about $7 billion. That's a new high by a long shot. Profit margins are higher than at any time in the past decade as cutbacks in overhead and improved operating efficiency permit many companies to carry more of each dollar of revenue down to the bottom line. Earnings for the overall chemicals and allied products industry, meanwhile, will increase almost as much to about $18 billion.

Several factors are responsible for this year's favorable performance by the chemical industry. Strong consumer demand throughout the year has benefited many chemical end markets, including packaging, apparel, appliances, furniture, and electronics. As a result, output of plastics and fibers and of the chemical intermediates that are needed to make them has risen steadily throughout the year. For the year as a whole, production of industrial chemicals and synthetic materials will be about 9% higher than in 1986. And for the overall chemicals and allied products industry the increase in output will be about 6%. Both figures are considerably higher than the 3% increase in production likely this year for U.S. industry as a whole.

Meanwhile, for the second year in a row, the chemical industry is harvesting the fruits of the drastic reorganization that it imposed upon its operations in recent years, especially in 1985. The chronic excess capacity, slow market growth, depressed prices, cutthroat competition, and consequent lackluster earnings that plagued chemical companies throughout the early 1980s led to widespread programs for repositioning, rationalization, and restructuring. Marginally profitable and money-losing businesses were shut down or sold off. Staffs were cut to the bone. And many major companies shifted their emphasis away from their traditional commodity chemical lines to focus more on the development of specialty products. These, presumably, will be less prone to competition and more likely to garner a favorable return on investment. Monsanto, for one, has slashed its investment in commodity petrochemicals from about a quarter of its total assets in 1980 to only 3% now.

The combination of increased output and scaled back plant capacity has greatly enhanced the industry's productivity. For the first time in several years, too, producers of many chemical products are enjoying a sellers' market and operating their facilities full out. In this year's third quarter, according to Federal Reserve Board statistics, plant utilization in the chemical industry rose to 84% of capacity, up from 80% a year earlier. The industry's operating rate has not been higher since 1974, and just five years ago it was as low as 68%.

In some notable old-line product areas, moreover, plants now are operating even closer to their upper limit. Chlorine and caustic soda producers, for example, were running their plants at about 90% of capacity—or over 100% of "effective" capacity, allowing for plants temporarily shut down—this fall, according to the Chlorine Institute. Output of the two workhorse coproducts will be up 4 to 6% this year to the highest level since 1980, largely because of strong demand from producers of vinyl chloride and other organic chemicals and from the pulp and paper industry. At the same time, however, with some 20 plants shuttered during the 1980s, chlor-alkali producers are making do with about 13% less capacity than they had in 1982. As a result, supplies are tight and suppliers, for a change,

now are thinking of expanding rather than shrinking capacity.

Ethylene producers, too, are hard pressed to keep customers supplied. Output this year will rise only a modest 3%, more because of capacity restraints than slow growth in demand. Current U.S. capacity of about 35 million lb per year is operating at well over 90%, so that further growth will be dependent on debottlenecking present units, upgrading their technology, or restarting plants now mothballed.

Makers of a number of other basic petrochemicals, especially monomers for making plastics, are similarly hard pressed to keep customers satisfied. And in the plastics industry itself, with total production for the first nine months of 1987 up 10% to 36 billion lb, producers are having little problem in finding a buyer for every pound they can turn out. Even man-made fiber plants are humming close to capacity.

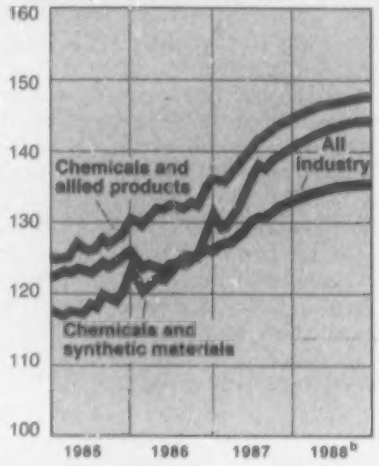
All of which leave chemical companies, for a change, sitting in the catbird seat. Selling prices reflect this. Producer prices for industrial chemicals, after having sagged steeply last year in response to the sharp decline in the cost of petroleum-based feedstocks, have rebounded sharply throughout most of 1987. Although for the year as a whole they will be up, on average, just about 4%, right now they stand 7 to 8% higher than at the end of 1986. Plastics prices, meanwhile, are more than 15% higher. Feedstocks also cost more this year, but chemical makers are now in a good position to pass such increases, and more, along to their customers.

The continuing slump in the value of the U.S. dollar relative to major foreign currencies has been yet another fundamental plus for the chemical industry. For one thing, earnings from the industry's far-flung operations abroad are magnified when translated into dollars at increasingly favorable exchange rates. Even more important now, however, U.S. chemicals are gaining a strong price advantage in overseas markets when competing with products made in Europe or Japan. As a result, $26 billion worth of U.S.-made chemicals will be sold to foreign customers this year, 15% more than in 1986, a hefty $3.4 billion increase over 1986 to U.S. companies' sales volume. At the same time, of course, the weak dollar has made U.S. chemical companies look like cheap and tempting targets to foreign companies interested in expanding in the big U.S. market.

All in all, increased exports, higher sales prices, strong demand, and improved efficiency have provided the U.S. chemical industry with the leverage, this year and last, to put its finances in better shape than at any time in more than a decade. Can the string be extended to three years?

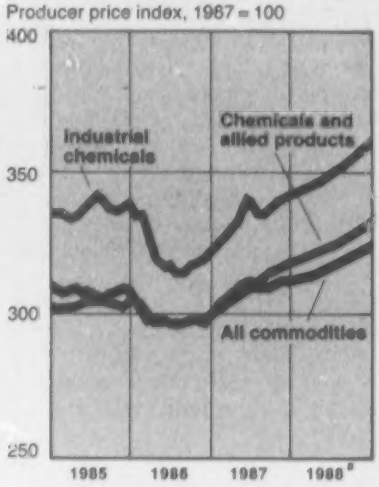
That depends, of course, on the continued health of the overall U.S. economy. Economists and business analysts generally have been moderately optimistic for 1988. Most are looking for gross national product, after adjustment for inflation, to increase about 1.5 to 2.5%—a rate of growth that probably will be slightly below this year's. And the consensus is that, although the rate of ex-

Growth in production is likely to taper off . . .



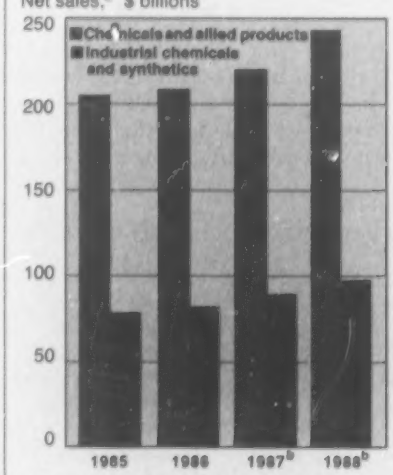
a Seasonally adjusted. b C&EN estimates.
Source: Federal Reserve Board

. . . but prices of many chemicals are climbing . . .



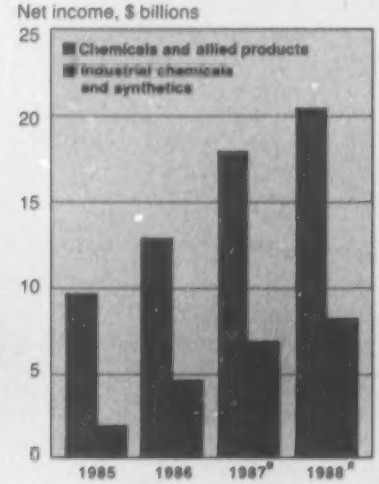
a C&EN estimates.
Source: Bureau of Labor Statistics

. . . and a steady rise in sales volume . . .



a Excludes sales of foreign subsidiaries. b C&EN estimates. Source: Bureau of the Census

. . . brings sharp growth for chemical producers' profits



a C&EN estimates. Source: Bureau of the Census

pansion may slow during the latter half of 1988, the U.S. will enjoy an unprecedented sixth year of steady economic progress.

Probably the biggest uncertainty at present is the potential fallout from the stock market collapse. It is still too early to assess just how the $1 trillion or more in losses suffered by investors this past October and November will impact consumers' spending plans or businessmen's investment decisions. But consumers have been the linchpin in the economic expansion of the past few years, and if they indeed have been badly shaken by events on Wall Street, further growth in gross national product would likely be slowed—or even stopped.

If the economy does manage to eke out another year of slow growth, 1988 will be one more period of high production, rising sales, and strong profits for U.S. chemical firms. It is true, certainly, that two of their most important markets—housing and the automobile industry, both of which have been slumping this year—are likely to be less buoyant in 1988 as well. Housing starts this past October were at the lowest level since early 1983, and, for the year as a whole, starts probably will be down 10% from 1986. A decline of nearly the same size would not be surprising for next year, also. That, in turn, will undercut a big market for plastics, coatings, and fibers.

The automotive market, another vast outlet for these chemical products, also is facing cloudy prospects. For all of 1987, its sales probably will total about 10 million cars, down sharply from the 11.5 million sold last year. Consequently, car makers have been trimming back their output since midyear. Auto production is likely to total about 7.1 million units for the entire year, down 9 to 10% from 1986. And already, the three major U.S. car companies have trimmed their production schedules for 1988's first quarter to a level 13% below what they rolled off their assembly lines in this year's first three months. For all of 1988, output is likely to drop at least 5%.

Growth is likely to slow, also, for demand from other outlets, such as appliance and furniture makers and the textile industry. But even if chemical production does not rise appreciably above its present level, it will average about 4% higher next year than in 1987.

It's more likely, though, that production of chemicals, plastics, and synthetic fibers will rise 5 to 6%. Prices, too, probably will be 4 to 5% higher next year. That works out to at least a 10% increase in sales, to about $100 billion. And with costs under good control and plants operating mostly at optimum rates, profits are expected to continue to move up smartly. Although growth is not likely to be as extensive as this year's, a further rise of 15 to 20% seems a good bet.

On the other hand, if the economy should fall into recession before the end of 1988—an event that every business analyst is thinking about at present but most are still dismissing—chemical industry executives argue that most companies are now well positioned to ward off its effects better than at any time in the recent past.

The industry's leaner, fitter stature and robust balance sheets have made it more resistant to a slump in demand for its products. Earnings would be hurt, certainly, but they probably would hold up reasonably close to this year's levels. □

Continued moderate growth is likely for production of major chemicals and polymers

	1985	1986	1987	1988
INORGANIC CHEMICALS				
Thousands of tons unless otherwise indicated				
Ammonia	17,319	14,474	15,650	16,000
Chlorine gas	10,402	10,436	10,900	11,200
Hydrochloric acid	2,803	2,413	2,450	2,550
Nitric acid	7,645	6,734	6,800	7,100
Oxygen, billions of cu ft	357	347	365	380
Phosphoric acid	10,607	9,578	10,300	10,600
Sodium hydroxide	10,790	10,691	11,400	11,700
Sulfuric acid	39,890	35,759	38,500	40,000
ORGANIC CHEMICALS				
Millions of lb unless otherwise indicated				
Acetic acid	2,897	2,728	3,000	3,150
Acetone	1,788	1,910	2,050	2,100
Acrylonitrile	2,349	2,182	2,400	2,550
Benzene, millions of gal[a]	1,283	1,362	1,520	1,600
Butadiene	2,340	2,546	2,700	2,800
Cumene	2,627	3,745	4,200	4,500
Cyclohexane	1,657	2,070	2,250	2,400
Ethylene	29,847	32,859	33,800	35,500
Ethylene glycol	4,178	4,771	4,400	4,700
Formaldehyde	5,606	5,549	5,800	6,000
Methanol	5,003	7,205	7,450	7,800
Phenol	2,841	3,115	3,300	3,450
Phthalic anhydride	820	863	1,050	1,100
Propylene	14,887	16,522	18,200	19,600
Styrene	7,622	7,888	8,200	8,600
***o*-Xylene**	675	788	950	1,000
***p*-Xylene**	4,779	5,035	5,300	5,600
PLASTICS				
Millions of lb				
Polyethylene, high density	6,671	7,182	8,000	8,500
Polyethylene, low density	8,689	8,903	9,700	10,200
Polypropylene	5,139	5,812	6,650	7,100
Polystyrene	4,054	4,470	4,800	5,000
Polyvinyl chloride	6,772	7,256	7,950	8,250
SYNTHETIC FIBERS				
Millions of lb				
Acrylic and modacrylic	631	616	630	650
Nylon	2,343	2,514	2,750	2,850
Olefin and vinyon	1,249	1,393	1,480	1,550
Polyester	3,341	3,305	3,550	3,650

a Petroleum refiners only. **Sources:** Bureau of the Census, International Trade Commission, Society of the Plastics Industry's Committee on Resins Statistics, Textile Economics Bureau, C&EN estimates (for 1987 and 1988)

U.S. surplus in chemical trade broadens markedly as exports of chemical products surge

Thanks to the sagging dollar, U.S. chemicals are making bigger inroads in European and Asian markets

Earl V. Anderson, C&EN New York

The U.S. chemical industry is continuing to rebuild its once-dwindling chemical trade surplus, which had gradually shrunk from an impressive $12.1 billion surplus in 1980 to $7.2 billion by 1985. The industry pushed its surplus slightly higher to $7.8 billion last year, on the strength of a 5% increase in chemical exports.

This year, however, foreign trade of the U.S. chemical industry will increase substantially more. Thanks to a dollar that continues to grow weaker against major foreign currencies, chemical exports will jump a healthy 15% to about $26.2 billion. Meanwhile, the weaker dollar will help to limit chemical import growth to only 5%. If chemical imports do, in fact, weigh in at $15.7 billion this year, as expected, the U.S. chemical trade surplus will expand to $10.5 billion. And the chemical industry will have recouped two thirds of the decline in its trade surplus that it suffered in the early 1980s.

Given this year's strong export performance, the U.S. share of world chemical exports might be expected to increase. It won't. It will slip slightly to 14.4% from last year's 14.5% and the even higher 15 to 17% range in which it hovered during the early 1980s, when U.S. chemical export performance was much less vigorous than it is this year.

Why this statistical aberration? It certainly isn't because other countries are outperforming the U.S. when it comes to exporting chemicals. The answer, again, lies with the depreciating dollar.

Measured in dollars, world chemical exports this year will fall just short of $200 billion. That's about a 15% advance, roughly the same percentage that world chemical exports (measured again in dollars) grew last year.

But realistically, the economies of the world's major industrialized nations just aren't strong enough to support that kind of growth in chemical exports. And the debt problems of many of the developing countries, particularly some of those in Latin America, make it impossible for them to boost their imports by such a large amount.

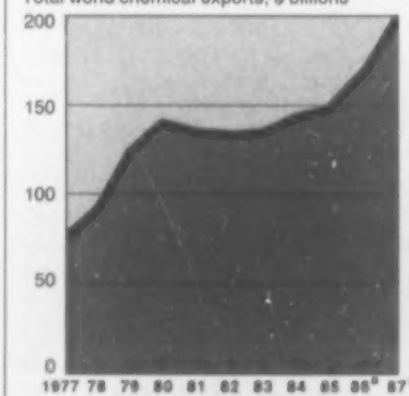
A more reasonable "guesstimate" of world chemical export growth this year is about 5% in real terms. The inflated 15% dollar-based figure results from the swiftly changing exchange rates of the dollar against other currencies.

Take, for example, the chemical exports of the European Community (EC). Most recent complete EC statistics (through June) show that EC chemical exports are actually running about 1% lower than they were last year. But EC reports its export figures in European currency units, or ECUs, which are weighted "basket" units based on the gross national product and trade of member countries.

In 1986, one U.S. dollar equaled 1.063 ECUs. This year, however, a dollar equals only 0.880 ECU, 17% lower than last year's conversion rate. Not surprisingly, EC chemical exports, measured in dollars, are up 19.5% over last year, even though they are down 1.2% in ECUs.

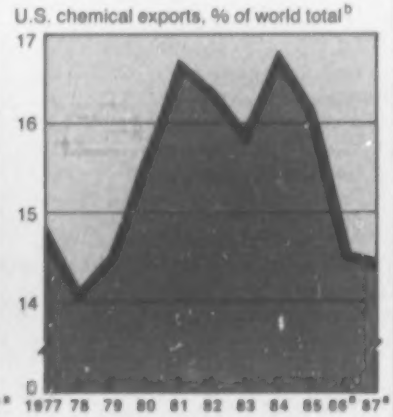
Cheaper dollar inflates value of world chemical trade . . .

Total world chemical exports, $ billions



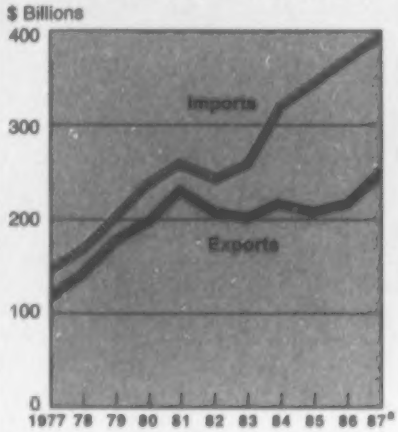
. . . but deflates U.S. share of the total value

U.S. chemical exports, % of world total[b]

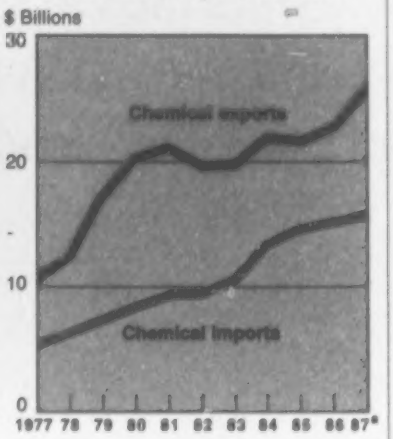


a C&EN estimates. b Defined as U.S. chemical exports as percent of world chemical exports less U.S. chemical imports. **Sources:** United Nations, Organization for Economic Cooperation & Development, European Community, Japan Ministry of International Trade & Industry

Deficit mounts higher for total U.S. foreign trade . . .



. . . but surplus in chemical trade shows improvement



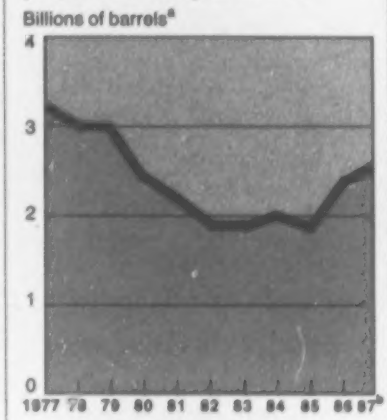
a C&EN estimates. Source: Bureau of the Census

This is why U.S. chemical companies seem to be denied a higher share of world chemical exports, despite their strong export effort this year. The same story is repeated in Japan, where 1987 chemical exports will be 20% higher in terms of dollars, but less than 5% higher when valued in yen.

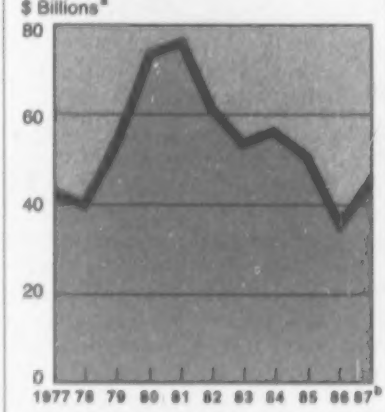
Because the weaker dollar makes imports from the U.S. less expensive in those countries whose currencies have appreciated most against the dollar, it is not surprising that most of the gains in U.S. chemical exports have come in the major industrialized nations. U.S. chemical exports to Western Europe, for instance, will be about 18% higher than they were last year. And the countries of Western Europe, as a bloc, make up the largest single U.S. chemical export market.

Although the Canadian dollar has not appreciated as much against the U.S. dollar as some European currencies have (especially the West German deutsche mark), U.S. chemical exports to Canada will score an impressive 30% advance this year. Chalk that up primarily to Canada's strong economy. U.S. chemical exports to Japan, however, are only 10% higher than last year, even though the yen has appreciated dramatically against the U.S. dollar.

U.S. is stepping up its petroleum imports . . .



. . . as higher prices escalate their total cost



a All petroleum products. b C&EN estimates. Source: Bureau of the Census

Surge in U.S. chemical exports is sparked by organic chemicals and plastics

$ Millions	U.S. chemical exports				U.S. chemical imports			
	1987a	1986	1985	1984	1987a	1986	1985	1984
Organic chemicals	$ 7,650	$ 6,293	$ 6,012	$ 6,093	$ 5,385	$ 4,704	$ 4,576	$ 4,265
Plastics and resins	5,400	4,301	3,777	4,050	1,930	1,837	1,631	1,484
Medicinals and pharmaceuticals	3,275	3,090	2,708	2,628	1,380	1,240	1,084	931
Fertilizers, manufactured	2,095	1,935	2,160	1,815	770	865	967	1,142
Inorganic chemicals	2,045	1,771	1,967	2,184	1,995	1,894	1,984	2,064
Radioactive materials	915	1,302	1,311	1,421	800	1,382	1,417	1,394
Pesticides and disinfectants	785	664	614	707	410	580	399	308
Flavors, perfumes, cosmetics, and toiletries	575	488	478	498	740	679	577	521
Pigments, paints, and varnishes	420	333	322	335	425	348	266	232
Cleaning and polishing materials	365	302	292	308	205	214	172	118
Dyeing, tanning, and coloring materials	210	174	139	158	580	487	352	358
Explosives and pyrotechnics	80	81	100	146	125	111	103	84
Miscellaneous	2,385	2,032	1,878	1,992	955	560	1,005	797
TOTAL	$26,200	$22,766	$21,759	$22,336	$15,700	$15,001	$14,533	$13,697

a C&EN estimates. Source: Bureau of the Census

U.S. trade deficit rises despite higher exports of chemicals and other manufactured goods

$ Billions	U.S. exports				U.S. imports			
	1987[a]	1986	1985	1984	1987[a]	1986	1985	1984
Chemicals	$ 26.2	$ 22.8	$ 21.8	$ 22.3	$ 15.7	$ 15.0	$ 14.5	$ 13.7
Machinery and transportation equipment	104.7	95.3	94.3	90.0	173.7	161.6	137.3	119.2
Other manufactured goods	35.7	30.6	29.3	30.8	118.6	105.5	95.0	88.6
Food and live animals	18.7	17.3	19.3	24.5	20.8	20.8	18.6	18.0
Beverages and tobacco	3.4	2.9	3.0	2.9	4.0	3.9	3.7	3.7
Animal and vegetable oils and fats	1.0	1.0	1.4	1.9	0.4	0.5	0.7	0.7
Mineral fuels, lubricants, and related materials	7.6	8.1	10.0	9.3	43.6	37.3	53.9	61.0
Crude materials (inedible) other than fuels	19.5	17.3	16.9	20.2	11.2	10.4	10.4	11.1
All other products	19.9	11.0	11.0	10.1	12.0	14.9	11.1	9.8
TOTAL	$245.0[b]	$217.3[b]	$213.1[b]	$217.9[b]	$400.0	$370.0	$345.3	$325.7

a C&EN estimates. b Includes re-exported imports (not included in individual product categories). Source: Bureau of the Census

Where U.S. chemical exports, along with the exports of most other products, continue to suffer is in the debt-ridden developing nations. The most indebted nations, such as Brazil, are in Latin America, which is a very large and important outlet for U.S. chemicals.

In 1980, Latin America accounted for almost 24% of all U.S. chemical exports. But the debt problems of several of the region's largest and most economically advanced nations have put the brake on their ability to import. This year, for instance, U.S. chemical exports to Latin America will increase a miserly 1% over 1986. And the share of U.S. chemical exports that Latin America takes in will drop to only 15%.

On the other hand, U.S. chemical exports to developing nations in Asia are increasing rapidly. These nations, in fact, now rival Latin America as a big market for U.S. chemical exports.

The developing countries of Asia don't have the debt burden that Latin American countries do. And, led by the so-called newly industrialized countries, such as Taiwan, South Korea, Hong Kong, and Singapore, industrial development in this area has been swift.

As a result, this year U.S. chemical exports to the area likely will be up almost 20%. And its importance as a chemical market, compared with Latin America, has grown markedly. This year, the developing countries of Asia will import 15% of all U.S. chemical exports, about the same as Latin America's share. In 1980, those shares were 13% and 24%, respectively.

The betting is that developing Asia will continue to grow as a market for U.S. chemicals. But whether Latin America can regain its former stature is a big question. Most observers don't think it will happen any time soon.

It's a catch-22 situation in Latin America. The most heavily indebted countries there can't increase their borrowing to pay for additional imports. And to pay for their existing debt, they must run large trade surpluses. This, in turn, means throttling back on imports and increasing their own exports.

For them to increase their exports, however, implies that the industrialized countries, especially the U.S., must increase their imports from the developing country debtors. But the U.S., of course, has a troublesome trade deficit of its own.

Total U.S. exports this year probably will increase 13% to $245 billion. Imports, although held to only an 8% advance, nevertheless will reach a record $400 billion. This combination will push the U.S. trade deficit up slightly to $155 billion from last year's $152.7 billion, despite the effects of a much weaker dollar.

The U.S. will pay $45 billion for imports of oil and related products, almost $5 billion more than last year. Without this increase, the trade deficit would have been slightly lower than it was last year.

One expert sees a danger in lowering the trade deficit too rapidly. Albert M. Wojnilower, senior adviser and managing director of First Boston Corp., says that the deficit can be lowered by increasing exports and substituting domestic products for imports, by reducing domestic demand, or by protectionism. The first proposal, he says, could lead to inflation. The second is a euphemism for recession. And the third, protectionism, is hardly desirable. "I see no choice," says Wojnilower, "but to be content with glacial progress until the [newly industrialized countries] become vigorous buyers as well as sellers." □

Sales of U.S. chemicals to Europe, Asia, Canada rise sharply

$ Millions	1987[a]	1986
U.S. CHEMICAL EXPORTS		
Canada	$ 3,460	$ 2,668
Latin America	4,060	4,025
Western Europe	8,330	7,032
Eastern Europe	365	385
Japan	3,380	3,081
Australasia	840	689
Communist Asia	605	441
Middle East	365	345
Rest of Asia	4,035	3,377
Africa	500	447
Other	260	276
TOTAL	$26,200	$22,766
U.S. CHEMICAL IMPORTS		
Canada	$ 2,985	$ 2,752
Latin America	960	942
Western Europe	7,865	7,357
Eastern Europe	155	327
Japan	2,070	1,792
Australasia	235	221
Communist Asia	205	179
Middle East	265	238
Rest of Asia	645	623
Africa	80	326
Other	235	244
TOTAL	$15,700	$15,001

a C&EN estimates. Source: Bureau of the Census

Fertilizers and fibers are major weak spots in otherwise strong year for chemical producers

Despite slow growth in the overall economy for many chemical products, supplies now are tight

Dermot A. O'Sullivan, C&EN London

The European chemical industry is ending 1987 in excellent shape. Throughout 1987, demand for most of its products has been at record levels, many plants have operated above their original design capacities, and company profit margins, especially for petrochemicals, have been at their highest since 1979. The summer business lull that often shows up in slack results for the third quarter didn't materialize this year.

Market watchers are looking very carefully at the turn of events. Comments James W. Dawson, head of the planning and integration division at Shell International Chemical: "For several products, we have been seeing plant liftings (deliveries by producers) that are higher than can be explained by the growth in the European economies, by the general trading behavior, or by substitution effects. In other words, liftings seem a little overheated. This overheating might reflect the filling of the supply chain from the chemical producers to the ultimate user."

Certainly, many of Western Europe's macroeconomic indicators point to anything but a booming economic climate. Throughout the European Community (EC) as a whole, which comprises 12 of Western Europe's 17 countries, unemployment continues high, averaging 11.8% of the civilian labor force, little changed from last year.

On a more positive note, inflation in EC continued downward, with consumer prices up only 3.2% on average this year. Although the inflation rate may go up slightly to 3.4% next year, it will remain well below EC's 1980 average of 13.2%.

Gross domestic product, a key indicator of economic activity, on average this year is a mere 2.2% ahead of last year. The outlook for next year is that the rate of growth will be about the same. Spain registered the highest rise, a comparatively robust 4.1%, with Portugal not far behind at 3.7%. But half the EC countries are in the 1.2-to-2.5% range.

Contradicting such lackluster overall growth, however, demand at the consumer level remains high. A gradual lowering of interest rates, for example, has led in turn to a drop in mortgage rates, the cost of credit for buying cars, and the like, all of which provides a boost for chemical products.

According to a survey made by The Economist Intelligence Unit in London, output of cars by Europe's six main car manufacturing countries will reach nearly 11.9 million units this year, almost 4% more than in 1986. A dip is likely next year, but at an anticipated 11.6 million or so, the total still will exceed last year's level.

Automobiles are providing a growing market for plastics used for specialized engineering parts and to reduce weight. David Oxley at the London office of Chem Systems International believes that each vehicle may use, on average, 230 lb of polymers in 1990, about twice the amount that went into cars in 1980.

Growth in output of chemicals generally looks good. Industry groups in the Netherlands, Spain, Sweden, and the U.K. expect chemical output this year to increase 6% beyond 1986. Belgium, Finland, and Switzerland are the only countries of those polled for which growth has slowed, both this year and last.

Commodity petrochemicals have been in high demand throughout the year. Naphtha crackers have been running at near their design capacity load, with output of ethylene expected to reach 13.5 million metric tons or so in Western Europe, about 5% more than last year. Demand for propylene has been growing at an even faster rate, so much so, in fact, that the olefin is in tight supply.

In sharp contrast to a few years ago when crackers throughout Western Europe were being taken out of service because of a decline in demand for olefins, talk within the industry now centers on how best to bolster production. Indeed, Neste of Finland, in a link with Belgium's Petrofina, is considering a new cracker at Antwerp with an annual ethylene output capability of 500,000 metric tons. A decision will be made early next year.

The prospect of a new cracker coming onto the European scene isn't being viewed with universal approbation, however. A more prudent approach, some observers argue, is to continue debottlenecking existing units and to step up their output by upgrading the technology. This already is being done, and by BP Chemicals' estimates can provide Western Europe with an incremental gain of some 400,000 metric tons annually, about 3% of the current installed ethylene capacity. Moreover, there is potential in the system to allow this level of annual

capacity "creep" to continue into the early 1990s.

Other petrochemicals, too, are in short supply, resulting in sharp price fluctuations during the year. Such is the case for styrene, as well as for plastics and synthetic elastomers made from it. Montedison, for one, is responding to the situation by installing a 440 million lb-a-year styrene plant in Italy. When it comes on stream in 1989, it will raise the company's annual capacity for the monomer, most of it used captively, to 1.1 billion lb.

Makers of commodity plastics—such as polyethylene, polypropylene, polystyrene, and polyvinyl chloride—are running their units flat out. The supply situation for conventional low-density polyethylene, in fact, is so critical in Europe that the plastic has been on allocation, a sharp change from a few years ago.

But it is polypropylene that is attracting the greatest amount of attention. The list of companies with plans for new European plants reads like a who's who of the industry, as the premise is that demand will continue to rise well into the next decade. Jacobus Franke, polypropylene marketing manager at DSM in the Netherlands, one of the companies with expansion plans, predicts that demand in Western Europe will increase from last year's 5.13 billion lb to 6.4 billion lb in 1990, and 7 billion lb in 1993. If his projection is accurate, and all the plans so far unveiled materialize, West European supply in 1993 might exceed demand by 1 billion lb.

Stuart H. Wamsley, who recently joined Morgan Stanley International, in London, as chemicals analyst, voices alarm at the new round of capacity increases taking shape in Europe. Recalling the severe rationalization and retrenchment that the industry went through in recent years, he contends that "many managers have yet to adjust to the fact that a degree of supply tightness will generate profits, while oversupply is more likely to lead to losses. The most cost-effective and profitable way of coping with the present tightness of supply without jeopardizing the future is for producers to continue maximizing the efficiency of their plants and processes. Such a course will provide more profit more quickly."

Shell's Dawson points out that if investment decisions are made simply by extrapolating from the present situation and there is a downturn in the economy when the plants are coming on stream, "then the industry would be faced with another of its years of concern. History has shown that you don't get it right in petrochemicals if you don't get the fundamentals right. We are being careful how we make our investment decisions, basing them on a variety of factors. Obviously, if the economy goes along reasonably steadily, then for certain products extra investment will be justified. But I advocate that we exercise much vision with vigilance."

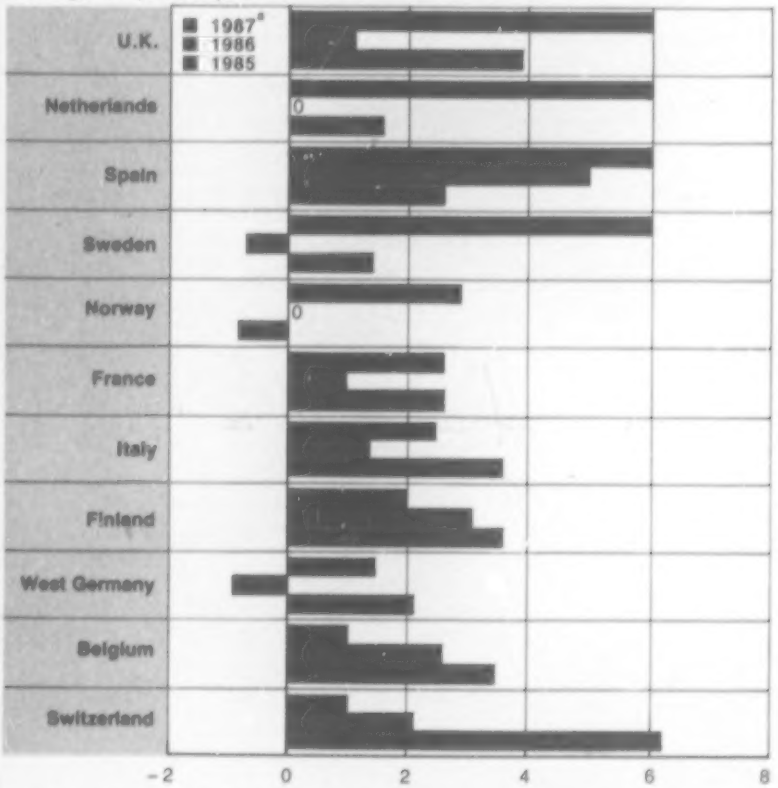
Fertilizers remain a depressed segment of the industry. And although the global market for nitrogen fertilizers may be heading for a slight upturn, thereby narrowing the gap between supply and demand, agriculture throughout Europe remains plagued by high stocks and overproduction of farm products. The consensus overall is that there is little prospect for growth in fertilizer usage.

European fertilizer producers, moreover, are having to cope with urea arriving in sizable quantities, much of it at dumped prices, from many sources, the U.S. included. CMC-Engrais, the association representing Western Europe's fertilizer makers, claims that these imports during the 1986–87 fertilizer year amounted to 911 million lb, four times greater than three years before. The share of the EC urea market that these imports captured increased from less than 4% to 12% in the same time period, CMC-Engrais maintains.

Consolidation moves likely will improve the economics of fertilizer operations, however. For instance, Kemira, an established fertilizer

Chemical output growth stronger in many European nations

% change from previous year



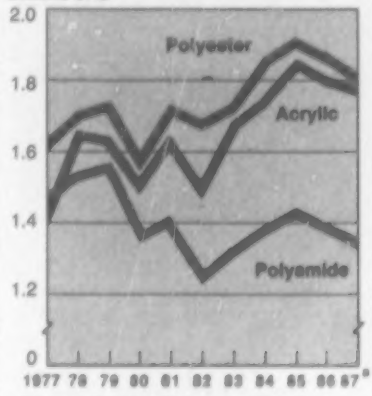
a Estimated. **Source:** National chemical federations for each country

company in Finland, has acquired the operations of Gechem, the chemicals arm of Belgium's Société Générale de Belgique. And Norsk Hydro has taken over full ownership of France's Cie. Française de l'Azote, giving it a one-third stake in French fertilizers.

Synthetic fibers haven't been doing particularly well in Europe, either. Production of acrylic, polyamide, and polyester fibers will be down this year, following a decline last year as well. Output of acrylics is expected to drop to 1.77 billion lb, more than 4% off the 1985 level. Production of polyamide, at 1.35 billion lb, and of polyester, at 1.80 billion, each will be 6% less than in 1985.

According to a recent study by Stanley Davies of The Economist Intelligence Unit, restructuring of the fibers industry probably is not yet complete. There may be some company mergers or product line exchanges, he believes, as producers try to increase their share of specific market sectors, so as to reduce overhead costs in what is virtually a static market.

Production of fibers sputters in West Europe



a Estimates. Source: CIRFS (International Rayon & Synthetic Fibers Committee)

The U.S. dollar has undergone a steady decline in value against European currencies since early in 1985. By September, the exchange rate was down more than 45% from its March 1985 peak against the Dutch guilder and West German deutsche mark. The fall was 43% against the Belgian franc, 40% against the French franc, 37% against the Italian lira, and 33% against the U.K. pound. The dollar's weakness has continued throughout October and November.

The decline is viewed with some concern by European bankers and economists who have been anxiously looking to Washington to see what steps are being taken to halt the decline. Their present stance is a reversal from a few years back, when criticism was leveled at the dollar's growing strength.

Currency parity is a complex issue. A weaker dollar has both negative and positive ramifications for European chemical companies. One negative effect is that dollar sales

How to close the critical gap between measurement hardware

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and earnings translate into lower figures in the currencies of the countries where the companies are headquartered. Conversely, of course, the sales and profits of the European arms of U.S. firms look particularly good right now when viewed in dollar terms.

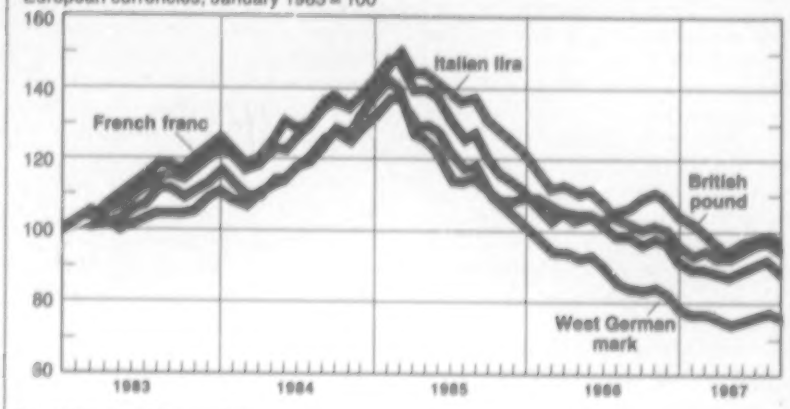
Another negative, so far as the Europeans are concerned, is that they risk losing their competitive edge against U.S. exports. So far, this has most affected goods sold in dollar trading zones.

London-based ICI comments that as yet, "U.S. producers have not moved into European markets in a significant way. With a prolonged period of dollar weakness, or a large downturn in the U.S. market, this could change, however."

European companies gain from a weaker dollar, on the other hand, when they purchase oil and naphtha, which are priced in dollars. So petrochemical feedstocks, in local currencies, become less expensive.

Dollar plummets to lowest level in more than five years

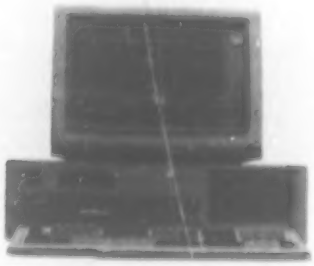
Relative value of U.S. dollar versus four Western European currencies, January 1983 = 100



Source: International Monetary Fund

As David Glass of Chem Systems International points out, European companies are disadvantaged when their fixed costs are calculated in U.S. dollars. He cites the case of a hypothetical naphtha cracker in West Germany that incurred fixed costs of, say, $35 per ton of ethylene when the dollar was at its high of 3.26 deutsche marks in 1985. Today, even assuming that fixed costs have come down since then because

and your spreadsheet.



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of improved operating rates, the dollar equivalent is about $64 per ton because of the weaker dollar, an 85% increase. The increase in fixed costs is especially significant when European producers are competing against their U.S. counterparts in export markets priced in dollars. Moreover, it confers an advantage to U.S. imports into Europe itself.

Another outcome of the lower dollar is that it costs European companies less, in terms of their local currencies, to make U.S. acquisitions. European managers argue that such acquisitions are decided on when they are seen to fit into longer term corporate strategies, independent of the exchange rate at the time. But they acknowledge that their purchases this year and last were less expensive than they might otherwise have been.

Such purchases have continued apace. Just last month, West Germany's Bayer further strengthened its U.S. position by buying Denka Chemical of Houston. Its chemicals are used to make agrochemicals, lube oil additives, polyester resins, and the like, areas in which Mobay, Bayer's U.S. subsidiary, already is active. In addition, Scientific Design, part of Denka, makes catalysts and provides chemical engineering and process licensing services.

This year also saw the incorporation of Celanese into Hoechst, an acquisition that was negotiated in the closing weeks of 1986. The move greatly enhances the U.S. presence of the West German company, providing it with a range of fibers and plastics, together with organic chemical intermediates.

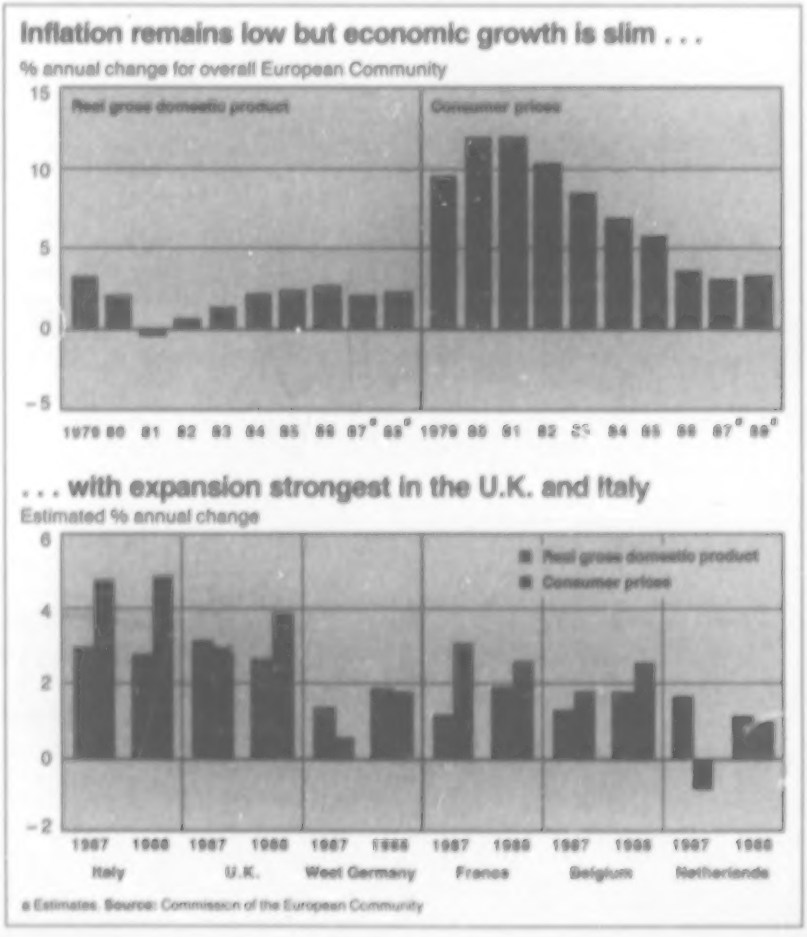
Courtaulds, a leading chemicals and textiles company based in London, is paying $140 million for Porter Paint of Louisville, Ky., a specialty maker of architectural coatings, enamels used in the graphic arts, and coatings for concrete and steel. Its activities will mesh with those of Courtaulds' International Paint subsidiary in the U.S.

ICI, meanwhile, has further extended its presence in the U.S. by acquiring Stauffer Chemical from Unilever, the Anglo-Dutch chemicals and foods giant. Within weeks of the midyear purchase, ICI hived off Stauffer's specialty chemicals businesses to Akzo and two months later followed this with sale of the basic inorganic chemicals part of the organization to France's Rhône-Poulenc. Three remaining small segments of the original Stauffer concern also will be sold, leaving ICI with Stauffer's extensive pesticide operations, which attracted ICI to Stauffer in the first place.

BP Chemicals also has gained a stronger U.S. position on the chemicals scene as the result of this year's purchase by British Petroleum, its parent company, of the 45% of Standard Oil it hadn't already owned. The Cleveland-based oil company's chemicals arm now is the Sohio division of BP Chemicals. In a separate move, BP Advanced Materials, another branch of the U.K. oil firm, bought Hitco from Owens-Corning Fiberglas.

Compared with such purchases by Europeans, entailing commitment of very large sums of money and resulting in their ownership of large segments of the U.S. chemical industry, steps being taken by U.S. chemical companies in Europe may appear comparatively modest. But this doesn't mean that their intention to maintain a presence there has lessened. In general, though, the expansions that are in progress center on selective areas in which the U.S. companies see themselves with a technical edge over the competition and where high growth is foreseen.

Arco Chemical, for instance, is set to become a leading European supplier of fuel oxygenates—*tert*-butyl alcohol (TBA) and methyl *tert*-butyl ether (MTBE)—with an eye to rising demand as lead additives are legislated out of gasoline. An 836 million lb-a-year TBA unit nearing completion at Fos in the south of France will raise the company's European annual capacity to 2.05 billion lb. And Arco will be the big-



e Estimates. Source: Commission of the European Community

Vehicle output may slacken

	Millions of cars and trucks			% change from previous year	
	1986	1987[a]	1988[a]	1987	1988
West Germany	4.60	4.61	4.35	0%	−6%
France	3.20	3.33	3.28	4	−2
Italy	1.83	1.89	1.89	3	0
Spain	1.53	1.60	1.65	4	3
U.K.	1.25	1.41	1.38	13	−2
Sweden	0.49	0.49	0.50	0	2
TOTAL	12.89	13.33	13.06	3%	−2%

a Estimated. Source: The Economist Intelligence Unit

gest producer of MTBE when units going up at Fos and Rotterdam come on stream, possibly next year.

Arco Chemical also strengthened its position in propylene oxide-based polyols this year by taking ownership of a Belgian 154 million lb-a-year operation from France's Atochem. And, partnered with EniChem, it is building a facility in Italy for making 24 million lb annually of Dylark, Arco Chemical's proprietary line of styrene-maleic anhydride engineering plastics.

Dow Chemical, which this year withdrew from North Sea oil and gas exploration and drilling, also has linked with EniChem, the petrochemicals arm of Ente Nazionale Idrocarburi, Italy's state-owned energy and hydrocarbons concern. Together, they will make special grades of advanced epoxy resins at EniChem's existing facilities at Pisticci in southern Italy.

Du Pont also has gone into business with EniChem by taking a 50% equity stake in Sclavo, a medical diagnostics and pharmaceuticals company based in Siena, Italy. Products include blood derivatives, vaccines, and industrial enzymes. In another venture with EniChem, Du Pont will provide its Aldyl polyethylene piping system for the natural gas industry, supplying product from its plant in England.

Elsewhere, Du Pont has a number of new projects under way. Ground breaking has taken place for a plant at Izmit, Turkey, where industrial nylon 66 yarn for tire reinforcement and other applications will be made in conjunction with the Turkish company, Haci Omer Sabanci. Adiponitrile to be used will come from Butachimie in France, jointly owned by Du Pont and Rhône-Poulenc. In Northern Ireland, Du Pont is readying a plant that will spin its Kevlar aramid fiber at an initial rate of 15 million lb annually. In Luxembourg, Tyvek spun-bonded polyolefin fabric soon will be made in a 44 million lb-a-year facility. And responding to a shortage of polyvinyl butyral film used as an interlayer in shatterproof glass, Du Pont will produce the material at Uentrop, West Germany, its first such unit outside the U.S. Growth in demand for the product also has prompted Monsanto to invest in additional capacity at its Belgian facility.

Recent unveiling of plans by West European companies to establish joint ventures in the U.S.S.R. could be the forerunner of other such moves in 1988 and beyond. Italy's Montedison and Occidental Petroleum, together with Marubeni of Japan, are linking with the Soviet Union's oil ministry in a major petrochemicals undertaking that could involve investment of up to $6 billion. Slated for the Ural region, the complex will draw on oil and gas produced in the area, and the non-Soviet partners will be allowed to export their share of the output.

Another project involves production of sulfur dyes, used mainly to color cellulosic fibers, by Tauria, a new company owned 49% by Switzerland's Sandoz and 51% by Soyuzanilprom, the U.S.S.R. organization responsible for dyes. A plant will be sited at Armyansk on the Black Sea east of Odessa. Sandoz will have exclusive rights to sell the dyes outside East Bloc countries.

These and other ventures that may emerge mark a departure from the commercial activities that took place with the U.S.S.R. in the past. The change reflects the drive by Soviet leader Mikhail Gorbachev to expand his country's economy and extend trade relations with the West. Some observers believe that as many as 200 or so joint-partnership projects are being discussed, not all of them, of course, focused on chemicals.

Europe's leading chemical companies, meanwhile, are directing increased development funding into commercial areas that until now haven't usually been associated with the more traditional thrust of the industry. Hoechst, for example, is moving further into advanced ceramics and the fabrication of engineering components made from them. ICI is adding to its team designing complete electronic systems, an outgrowth of a decision a few years ago to develop chemicals needed by the electronics industry.

Many European companies, too, are engaged in one aspect or another of genetic engineering. One of the most dramatic of these, with enormous commercial and social potential, is the search for novel crop varieties through the genetic manipulation of seeds.

Italy's EniChem is seeking crops that will have the inherent ability to resist fungal attack and to absorb nutrients with greater efficiency. And it has linked with the Max-Planck Institute of Crop Cultivation and Production Physiology in Cologne, West Germany, on work that could lead to plants that are immune to viruses.

ICI continues its aggressive entry into the seeds business with its recent purchase of MMG, a U.K. cereal seed-breeding company. This follows its June acquisition of the Belgian European Seeds Co. and, in the past couple of years, of Garst Seed in Iowa and Sinclair McGill in the U.K. And Shell International Chemical, already well entrenched in the seed business, this year decided to inject $20 million during the coming five years largely into seeds-related areas of research and agricultural biotechnology. This figure is above the existing rate of investment of about $20 million a year that Shell spends on plant genetics in the U.K. and elsewhere.

Such projects essentially are long term. "They need a great deal of faith," remarks Shell's Dawson. "But we certainly have that." □

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Strong domestic economy buoys chemical demand and profits

Chemical producers are focusing more on home markets as strong yen dims prospects for exports

Earl V. Anderson, C&EN New York

One Japanese chemical company has changed its name and another is planning to. In October, Toyo Soda Mfg. Co. became Tosoh. Now, Mitsubishi Chemical Industries wants to change its name to Mitsubishi Kasei.

Whatever the companies' reasons, these name changes are indicative of the chemical scene in Japan, where change is the name of the game. Companies strong in basic or commodity chemicals are pushing into every conceivable nook and cranny of specialty chemicals and other high-tech product areas.

Over the past few years, thousands of tons of basic chemical plant capacity has been scrapped in a major petrochemical industry restructuring effort. Now, however, demand for many basic petrochemicals is pushing output to capacity limits. Japanese chemical companies consequently are switching their thinking from scrapping to building.

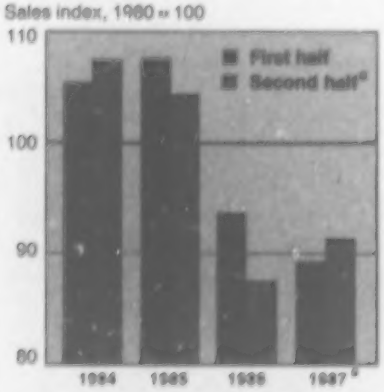
A year ago, Japanese chemical executives, along with those of virtually every other industry, worried about what would happen to their profits as the yen strengthened from 200 to the U.S. dollar in December 1985 to 150 in December 1986. Now, the yen has strengthened further to below 133 to the dollar. Yet profits, rather than tumbling, have soared.

Why? No doubt the emphasis on high value-added products has helped some Japanese chemical companies. But it's still too early in the transition to high tech for that to make a significant impact.

The bigger reason is that Japan has made the conversion from export-led economic growth to growth based on domestic demand much faster—and better—than expected. Certainly the Japanese economy has recovered from the beating that it took from the soaring yen in 1985 and 1986.

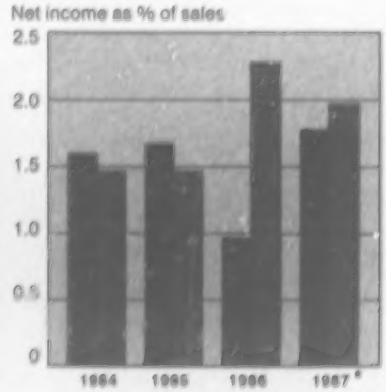
The Japanese government had pegged economic growth for fiscal year 1987, which ends in March 1988, at 3.5%. However, that growth may be somewhat lower—about 2.9% or 3%—with the yen at its present level of about 135 to the dollar. But whatever the economic growth rate, chemical company profits have been the beneficiary of this economic recovery. The domestically oriented economic spurt, buttressed by increases in housing starts, stronger domestic production, and higher consumer spending, has pushed up demand for many chem-

Sales stagnate for Japanese petrochemical firms . . .



. . . but net income will rise for the year as a whole . . .

. . . so that profit margins are holding firm



Note: Based on the results of 10 leading Japanese chemical companies: Mitsubishi Chemical Industries, Sumitomo Chemical, Asahi Chemical Industry, Toray Industries, Mitsui Toatsu Chemicals, Teijin, Showa Denko, Mitsubishi Petrochemicals, Dainippon Ink & Chemicals, and Sekisui Chemical. The fiscal year for most but not all of these Japanese companies ends March 31 of the following year. * Estimated. **Source:** Toyo Keizai Shinposha

ical products, including petrochemicals.

At midyear, production for all chemicals was a healthy 9.5% higher than it was a year earlier. Petrochemical production was up 10% and plastics output was running 11% higher. However, synthetic fibers, synthetic rubber, and fertilizer were among the chemical products that did not benefit from the economic upturn. For all of them, production was down.

Despite these weak spots, demand for chemicals has improved markedly during the past year. In addition, price increases, lower interest payments, and lower raw material costs are boosting profits for most Japanese chemical companies.

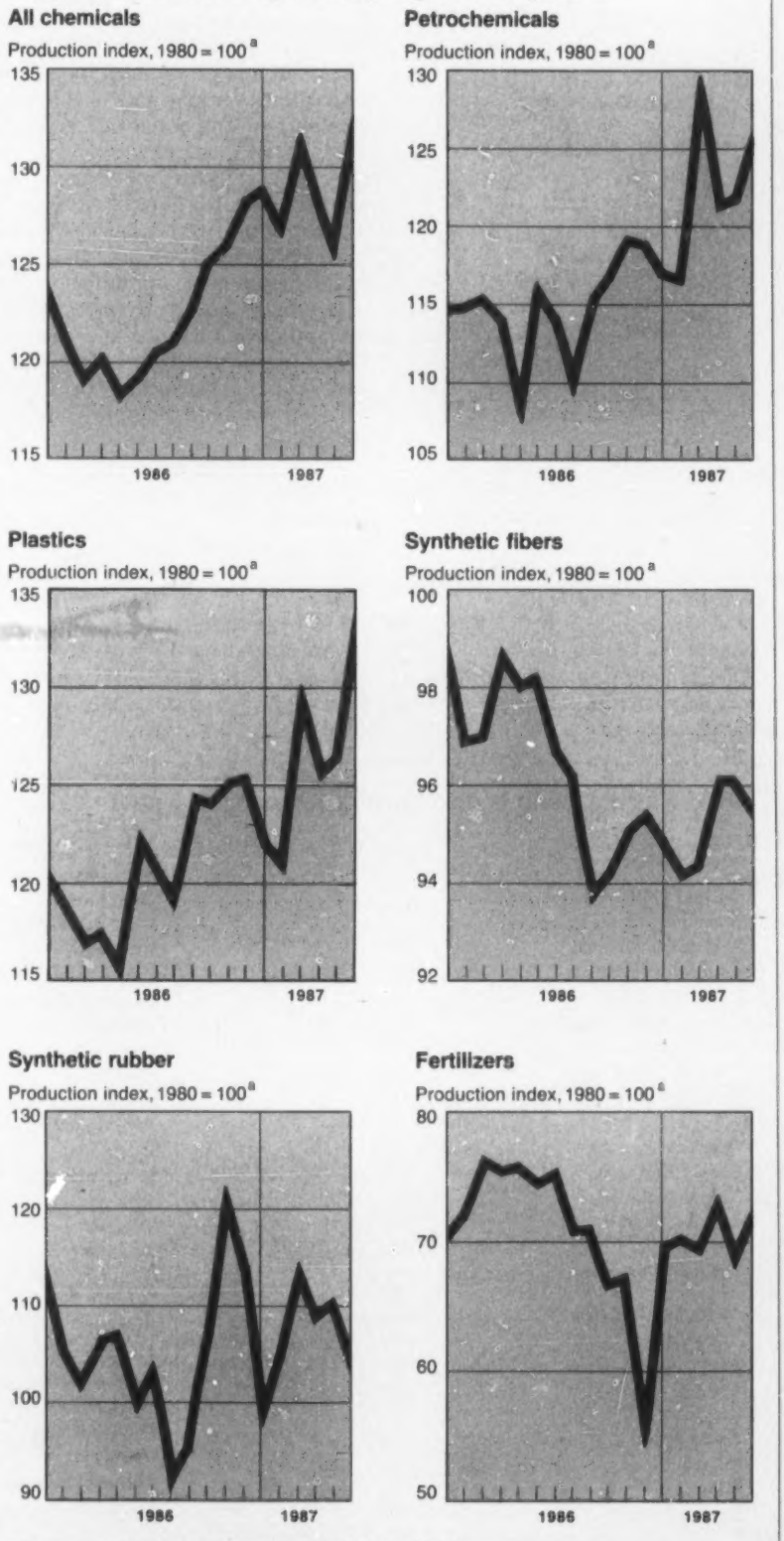
Showa Denko, for instance, expects profits for its fiscal year ending this month to increase almost 75% over last year. Mitsubishi Petrochemical foresees profits that will more than double those of a year ago. The profit picture was especially rosy in the first half of the fiscal year. A profit index of 10 leading Japanese chemical companies indicates that net income shot up 73% in the first half of fiscal 1987, compared with the first half of fiscal 1986.

The questions now uppermost in the minds of most Japanese chemical company executives are: What will happen to the yen-dollar exchange rate? How will it affect the domestic economy next year? And what will happen to chemical company profits?

The first question is difficult to answer. But it's not difficult to extrapolate what will happen to chemical industry profits if the yen does appreciate further against the dollar. According to a spokesman for Mitsubishi Chemical Industries, an even stronger yen will make life tougher for its customers. This, in turn, will hurt the company's business—and profits.

According to the respected Nomura Research Institute, at a yen-to-dollar rate of 140, the average profit of 100 major Japanese companies would go up 27% in fiscal 1988, ending March 1989. However, if the yen appreciates to 130, the fiscal 1988 profit advance will be limited to 17%.

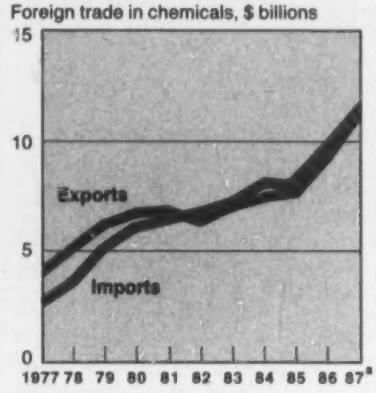
Output of chemicals generally higher this year



a. Seasonally adjusted. **Source:** Ministry of International Trade & Industry

Chemical imports continue to hold slight edge on exports

Foreign trade in chemicals, $ billions



a C&EN estimates.
Source: Ministry of International Trade & Industry

But Japanese companies, including chemical companies, have become adept at coping with a stronger yen. Many have developed strategies for remaining profitable, even with a stronger yen.

The imponderables about the future yen exchange rate hasn't held back chemical industry capital investment. A survey by the Economic Planning Agency conducted in March indicated that capital spending plans by all industry in fiscal 1987 called for only a 1.4% increase over the previous year. A more recent survey, in September, puts the increase at 7%. Capital spending in the chemical industry, however, will advance 17%, the agency adds.

Meanwhile, the Japan Chemical Industry Association says that most of its members expect that business will remain good, at least through the end of this fiscal year. For many chemicals, demand continues strong and supplies are tight. Vinyl chloride and ethylene dichloride are two examples.

Ethylene, the bellwether of the petrochemical industry, is enjoying a banner year. Output is expected to top 4.6 million metric tons, second only to the record 4.78 million metric tons produced in 1979.

Most Japanese ethylene producers are operating their plants at full capacity. The same is true of other products. Inventories of ethylene derivatives are declining.

If this good fortune is to continue, the impetus for growth will have to come from domestic markets more so than from exports. Japanese chemical exports are likely to increase 20% this year to $11.4 billion. But measured in yen, the increase is less than 5%.

Because of the strong yen, the prospects for dramatic increases in chemical exports are slim. On the other hand, that same strong yen could lure in more chemical imports.

Japanese chemical imports this year probably will hit $11.5 billion in 1987. Although that's an 18% increase measured in dollars, it's only a 2.5% increase when measured in yen.

But chemical imports may climb faster in the future. Japanese chemical leaders expect increasing chemical imports from the so-called "newly industrialized countries" of Asia, particularly South Korea and Taiwan. Indeed, as Japanese chemical companies participate more in joint-venture production in these countries, chemical shipments back to the homeland are bound to rise. □

Production growth is strongest among organic chemicals and plastics

Thousands of metric tons unless otherwise indicated	1986	Six months 1987	Six months 1985	% change
INORGANIC CHEMICALS				
Ammonia	1794	871	901	−3
Ammonium chloride	364	185	190	−3
Ammonium sulfate	1784	897	893	1
Calcium carbide	399	200	224	−11
Calcium superphosphate	514	269	278	−3
Carbon black	616	309	311	−1
Chlorine, liquid	881	452	458	−1
Hydrochloric acid	549	269	269	0
Nitrogen[a]	6293	3162	3137	1
Oxygen[a]	6786	3322	3429	−3
Sodium carbonate	1022	557	514	8
Sodium hydroxide	3077	1575	1524	3
Sodium silicate	603	313	289	8
Sulfuric acid	6561	3259	3383	4
Titanium dioxide	223	120	115	4
ORGANIC CHEMICALS				
Acetaldehyde	254	140	123	14
Acetic acid	300	165	135	22
Acetone	228	132	112	18
Acrylonitrile	546	271	266	2
Benzene[b]	2071	1146	1014	13
Butadiene	656	339	324	5
Butanol	248	120	113	6
Caprolactam	448	233	223	5

Thousands of metric tons unless otherwise indicated	1986	Six months 1987	Six months 1985	% change
Cyclohexane	515	276	262	5
Dioctyl phthalate	257	128	124	3
Ethylene	4291	2247	2073	8
Ethylene dichloride	1908	1021	926	10
Ethylene glycol	339	167	186	−10
Ethylene oxide	489	251	259	−3
Methanol	221	85	125	−32
Octanol	235	110	102	8
Phenol	260	162	126	29
Phthalic anhydride[b]	163	82	74	11
Propylene	3167	1650	1515	9
Propylene glycol	223	114	106	8
Styrene	1417	758	674	13
Terephthalic acid	1035	491	473	4
Toluene	805	428	404	6
Toluene diisocyanate	86	40	38	5
Urea	778	369	429	−14
Xylene	1570	856	756	13
PLASTICS				
Phenolic resins	313	159	155	3
Polyethylene	2066	1059	987	7
Polypropylene	1333	712	660	8
Polystyrene	1598	827	778	6
Polyvinyl chloride	1540	875	744	18
SYNTHETIC RUBBER	1150	586	576	2

a Millions of cubic meters. b Petroleum-based product only. Source: Ministry of International Trade & Industry

Profits make a strong recovery for the chemical industry

Exports are outpacing domestic demand for chemical products, but fertilizers remain depressed

Earl V. Anderson, C&EN New York

Canadian chemical firms came roaring out of the third quarter of 1987 with strongly improved profits. And, although Black Monday—Oct. 19—raised havoc with their stock prices, as it did with those of their U.S. competitors, at least some Canadian chemical company leaders don't expect their sales or earnings to slow down during the fourth quarter.

J. Edward Newall, chairman and president of Du Pont Canada, says that the outlook for the fourth quarter "remains excellent." And Paul H. Williams, executive vice president of Celanese Canada, expects that improved profits in many product lines, including polyester staple fiber, chemicals, and industrial products, will give his company an excellent year.

Indeed, most Canadian chemical companies would be happy with their 1987 results any year. But the chances that 1988 will be a repeat of 1987 as far as profits are concerned are very slim.

Like it or not, Canada's economic health depends heavily upon the economy in the U.S. And although few U.S. economists think that the October stock market debacle will trigger an outright recession, most now are scaling back their growth estimates for 1988.

That's true in Canada as well. There, real gross domestic product will grow about 3.5% this year, and the consensus of earlier economic forecasts for 1988 had put GDP growth in 1988 at about 2.5 to 3.0%. Now, however, forecasters have revised their growth estimates downward to 2.0 to 2.5%. And very few are willing to deny that the possibility of an economic downturn at least exists.

Either way, profits of Canadian chemical companies probably won't be up so strongly in 1988 as they will be this year. The combined profits of the four publicly traded companies regularly tracked by C&EN (C-I-L, Celanese Canada, Du Pont Canada, and Union Carbide Canada) soared a hefty 130% in 1987's third quarter. For the first nine months, the combined profits of these companies were up more than 50%. This was despite a sales rise of only 10% in the third quarter and a mere 2% for the first nine months.

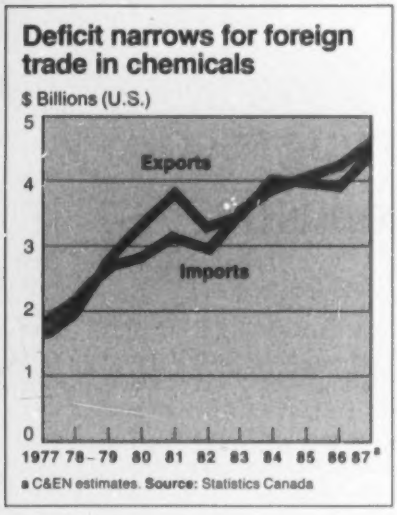
A large portion of those profits come from a much-improved export market. Du Pont Canada, for instance, says that this year's export demand for industrial yarns, polyethylene, and specialty polymers has been particularly strong. And for Celanese Canada, chemical sales to Europe have been exceptionally brisk. In fact, the company says it is "sold out" in some products.

The export market is growing more rapidly than the domestic market for the Canadian chemical industry. Statistics through August (the latest available) indicate that shipments of Canadian chemicals and chemical products are 3 to 4% higher than they were last year. That's better than the shipments for all manufacturing industries, which are up only 2.3%. But this year, Canadian chemical exports probably will increase a solid 15% to $4.5 billion (in Canadian dollars, the increase is a less dramatic but still sizable 9%). Higher prices, as well

Petrochemical output surges as fertilizer chemicals slump

Thousands of metric tons	Production 1987[a]	1986	1985	1984	1983	% change 1986–87
Ammonia	3060	3540	3620	3493	2888	−14%
Ammonium nitrate	765	948	1054	969	934	−19
Ammonium phosphate	925	1149	1301	1383	1259	−19
Benzene	755	635	688	557	580	19
Chlorine	1615	1536	1424	1424	1385	5
Ethylene	2170	1909	1744	1464	1196	14
Hydrochloric acid, 100%	153	153	158	161	170	0
Phosphoric acid, 100%	525	547	627	691	656	−4
Polyethylene, high density	270	242	229	227	211	12
Polyethylene, low density	1020	887	733	529	412	15
Propylene	650	628	648	665	715	4
Sodium chlorate	430	373	336	313	294	15
Sodium hydroxide	1770	1696	1589	1575	1528	4
Sulfuric acid	3425	3536	3890	4053	3686	−3
Urea	2000	2330	2033	2110	1445	−14

a C&EN estimates. Source: Statistics Canada



as higher volume, are helping to swell the total.

As usual, synthetic resins and elastomers are leading the export parade. Canadian plastics exports probably will be up 25 to 30% this year. Polyethylene has been a particularly strong export performer.

The one major blight on an otherwise stellar export performance is fertilizers. Weak demand and weak prices, particularly in the all-important U.S. market, continue to haunt Canadian fertilizer exports. Fertilizer sales in foreign markets are down from 15 to 40%, depending upon the particular product. Ammonium nitrate exports are particularly depressed.

This export record is reflected in Canada's chemical production picture. Output of plastics and their precursors, such as ethylene, is up sharply. Production of fertilizer materials, on the other hand, is down substantially.

By year's end, low-density polyethylene production in Canada likely will top 1 million metric tons, about 15% more than last year. Output of high-density polyethylene also will be up about 12% to 270,000 metric tons.

Statistics for polystyrene and polyvinyl chloride aren't reported in Canada, but they probably are having banner years as well. These plastics, along with the polyethylenes, are creating a strong demand for ethylene in Canada, a demand that Canadian producers are hard-pressed to meet.

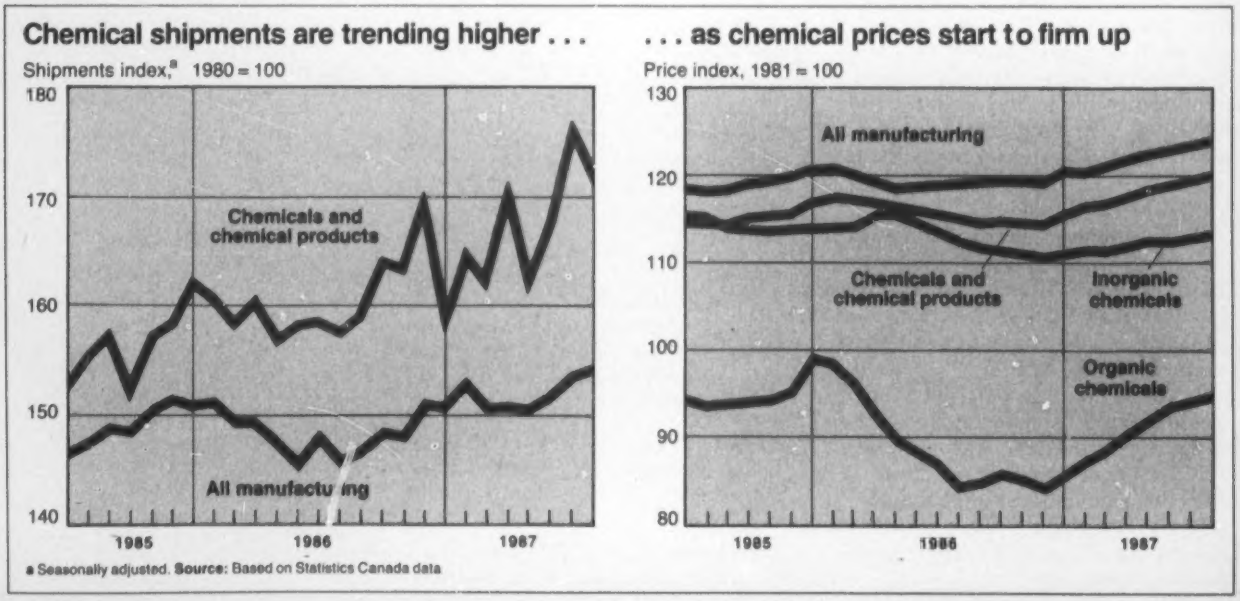
Ethylene output is likely to come close to 2.2 million metric tons in 1987, a 14% increase over last year. Canadian ethylene producers say that their plants are running full out. Little wonder, then, that Alberta Gas Ethylene has reactivated plans to build its third ethylene plant in Alberta, which will have an annual capacity of 680,000 metric tons. Along with some debottlenecking in two existing units, the new plant will bring the company's total ethylene capacity up to 2.04 million metric tons per year when it comes on stream in late 1991.

Meanwhile, fertilizer output is hard hit by poor export markets. Canadian ammonia production is estimated to be down 14% this year. Ammonium nitrate and phosphate output will tumble nearly 20%, and urea will suffer a 14% decline. Fertilizer producers say that nothing short of a drastic turnaround in exports will pull them out of their prolonged slump.

If the uncertainty or lack of consumer confidence triggered by Black Monday does slow down economic growth next year, Canadian fertilizer companies will have to wait even longer for their recovery. Most of Canada's chemical companies won't be as hard-pressed as fertilizer producers by slower economic growth in 1988. But there's little chance that they will manage to duplicate this year's strong profit growth again next year.

A slower-growing economy, or even an economic downturn, won't batter Canadian chemical companies the way they were in the 1981-82 recession. Since then, the major Canadian chemical companies have restructured and have become leaner and meaner and they now are in much better shape to contend with a faltering economy.

Assuming no recession, profits in the Canadian chemical industry could rise modestly—perhaps 5 to 10%—next year. But don't look for another 50% gain. □



Soviet bloc pushes reform of industrial planning and control

Chemical industry has key role in providing intermediates and end products needed in modernization drive

Richard J. Seltzer, C&EN Washington

Economic and industrial developments in the Soviet Union and East Europe this year are dominated by the reform process launched by Soviet leader Mikhail S. Gorbachev.

Approved in June by the Soviet Communist Party Central Committee and in July by the Supreme Soviet (the nominal legislature), Gorbachev's reform package calls for far-reaching perestroika (restructuring or transformation) in Soviet planning and management. The aim is to replace centralized, directive management of economic or industrial enterprises with more decentralized decision-making, open up a greater role for such market incentives as prices, wages, and profits, and slim down the bureaucracy.

The key element, the Law on State Enterprise, goes into effect Jan. 1, and its provisions will fully cover all enterprises by the start of the next five-year plan in 1991. This law establishes the state enterprise or association as the basic economic unit—self-financing, self-managed, and dealing with other units on the basis of contracts and full economic accountability. Profit is to become the main indicator of economic performance.

To varying degrees, the U.S.S.R.'s six East European allies—Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, and Romania—are also considering or undertaking reform programs. In the near term, reform efforts are likely to generate much confusion and controversy, and even to impede economic growth in the Soviet Union and East Europe, notes a study by WEFA Group (formerly Wharton Econometric Forecasting Associates). Polish voters have just rejected a reform program calling for austerity measures, for instance. Tangible boosts to growth may not appear until the early 1990s, WEFA adds. Tightening energy supply and hard-currency debt problems act as a spur to improve productivity and export competitiveness.

Chemical production plays a key role—supplying intermediates and many end-products required by the industrial modernization drive. Nations of the region thus give high priority to their chemical industries. Except for Czechoslovakia, their five-year plans (1986–90) target faster growth for chemicals than for industry as a whole.

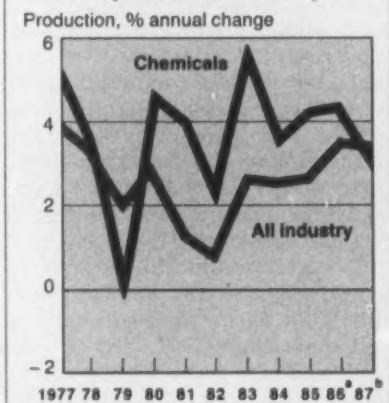
The Soviets, for example, have adopted a comprehensive program for "chemicalization" of their economy by the year 2000. Chief targets include plastics for the machine-building and construction industries; synthetic fibers for textile, tire, and other industries; multinutrient fertilizers and advanced pesticides for agriculture; and advanced products for use in microelectronics and optics. Soviet chemical output is to increase a third by 1990, compared with 1985, and industry overall is to grow only about a quarter.

Like other nations in the region, Poland's five-year plan seeks to change the structure of industrial production. It is trying to shift away from energy- and material-intensive products, increase productivity and "thrift and inventiveness inside enterprises," enhance worker incentives, introduce new technology, raise product quality, and direct a larger proportion of its production toward export.

Poland's chemical industry is to raise output nearly 5% in 1988, higher than any other branch (industry overall is to grow 4%). Greatest chemical growth will come in pharmaceutical production, to rise 10%. Output of several new commodities will start, including pentaerythritol (in facilities with a 4000 metric tons-per-year capacity), formic acid (2000 metric tons-per-year capacity), and cyclohexylamine (2000 metric tons-per-year capacity).

Czechoslovakia gives high priority to development of "small-volume chemistry," targeting higher value-added, sophisticated chemicals. Its goal is a 13% rise in chemical output by 1990, or 2.4% a year from 1986 to 1990. This is slightly below

Chemical output generally has outpaced all industry



a Preliminary. b For first 10 months; official Soviet figure for 1987 is for chemical and timber industries, rather than just chemical industry. **Sources:** Central Intelligence Agency, U.S.S.R. State Committee for Statistics for 1987 (CIA estimates for years prior to 1987 are lower than official Soviet statistics)

Chemical output up in U.S.S.R. but mixed in East Europe

Thousands of metric tons, 1986	U.S.S.R.	Bulgaria	Czechoslovakia	East Germany	Hungary	Poland	Romania
Mineral fertilizers[a]	34,700	674	na	5046	1040	2526	na
Change from 1985	4.5%	5.1%	na	4.2%	−2.4%	11.3%	na
Nitrogen (N)	15,200	541	614	1252	584	1445	na
Change from 1985	6.9%	15.4%	16.7%	16.1%	−3.3%	15.2%	na
Phosphate (P_2O_5)	9,100[b]	132	307[b]	309	163	948	na
Change from 1985	5.9%	−23.0%	−1.0%	3.3%	25.4%	6.6%	na
Potassium (K_2O)	10,400	—	na	3485	293	133	na
Change from 1985	0.3%	—	na	0.6%	−12.0%	4.7%	na
Sulfuric acid, 100%	27,900	806	1292	883	543	2969	na
Change from 1985	7.2%	−0.5%	−0.4%	0%	4.4%	3.7%	na
Ammonia[c]	19,400	na	na	1197	762	na	na
Change from 1985	6.4%	na	na	−1.1%	−3.5%	na	na
Plastics	5,344[d]	na	1140	1045	423	631	na
Change from 1985	6.5%	na	3.4%	−0.3%	8.7%	4.6%	na
Sodium hydroxide,	3,229	144	335	638	202[e]	427	na
Change from 1985	5.7%	−4.6%	0.9%	−4.3%	4.1%	3.1%	na
Synthetic rubber	2,250	26	76	130	56	116	162
Change from 1985	5.9%	0%	8.6%	−7.1%	27.3%	−7.9%	3.8%

a Nutrient content basis. b Includes ground phosphate rock for direct application and phosphate animal feeds. c Nitrogen content. d Includes resins for man-made fibers. e Includes regenerated NaOH. na = not available.
Sources: Central Intelligence Agency, WEFA Group (formerly Wharton Econometric Forecasting Associates), Foreign Broadcast Information Service, state central statistical bureaus

the goal of 3% a year for all industry. However, production of organic dyes, fine chemicals, pesticides, and pharmaceuticals is to grow at least 40% each by 1990, with the aim of "markedly strengthening the export ability in these branches."

East Germany's five-year plan seeks to raise plastics output 117% by 1990, emphasizing materials for microelectronics, metal processing, construction, and consumer goods industries. Synthetic fiber production is to grow 132%, with corresponding stepups in production of acrylonitrile, terephthalic acid, and caprolactam. And for the first time, East Germany will produce "highly refined special product ranges of carbon and aramide fibers" for strengthening polymer compounds. Between 1986 and 1990, East Germany also plans to increase chemical plant construction 7% a year.

Economic results this year make it unlikely that the Soviet Union and most East European nations will meet their 1987 targets, also casting doubt on achievement of their overall five-year goals. Growth of industrial production slowed this year for most countries of the region. Severe winter conditions depressed first-quarter activity, but social unrest and structural bottlenecks also hamper growth in several nations.

Soviet industrial output was up 3.4% for the first 10 months of 1987, compared with the same period in 1986. This falls below the target of 3.8% for all of 1987, and is a considerable drop from the 4.9% growth achieved in all of 1986, according to official statistics. (Preliminary figures from the Central Intelligence Agency list just 3.6% growth for 1986, after eliminating what it considers upward bias due to double counting and hidden inflation.) Moreover, the Soviet goal for 1987 already was short of the 4.6%-a-year growth set by the five-year plan.

Growth of the Soviet chemical industry and timber complex also slowed to 2.9% through October. Production of plastics, sulfuric acid, and ammonia fell short of target, as did output of chemical and oil field equipment.

Total industrial output for the six East European nations rose 2.9% in the first half of 1987, according to a report by the United Nations Economic Commission for Europe, based on official statistics. This falls short of the reduced goal for 1987 of 4.1% and the five-year plan target of 4.4% a year and is well below the rise of 4.7% achieved in all of 1986.

Bulgaria, for example, raised industrial production 3.5% through September, well short of the 1987 goal of 4.9%. The chemical and biotechnology industry grew only 1.1%. Poland's chemical industry grew 3.6% through August (the goal for the year is 4.7%).

However, Hungary's chemical industry is "an island in the slightly stormy sea of the people's economy," as a Hungarian newspaper puts it. Output rose 6.3% through August (overall industrial output rose just 2.9%). Chemicals provided 20% of all industrial production and were the leading export. Chemical exports in hard currency are expected to rise $100 million (16%) this year.

Romania continues to set very high growth targets (6 to 7% overall industrial growth and 8.9% chemical growth for 1987). It claims chemical growth rates of 18% a year between 1965 and 1985. However, it now publishes almost no statistics, and the reliability of what it does release is questioned. Nevertheless, Western analysts conclude that it is having another bad year, following poor years in 1985 and 1986. Industrial output grew just 1.1% through June, and chemical output fell 6%.

As for future prospects for the Soviet Union and Eastern Europe, many Western analysts once believed that Gorbachev, like previous Soviet leaders, would at most tinker with the system to make it work better. They did not think he would seek the fundamental structural changes they view as necessary to meet Soviet needs and goals.

Now, however, there is wide agreement that Gorbachev is serious about carrying out fundamental reforms. The question is whether he can overcome the many forces and interests opposing such changes. "Even with the best of efforts, this reform is unlikely to be fully implemented until the mid-1990s, and that is optimistic," notes Ed A. Hewett of the Brookings Institution, a specialist on the Soviet economy. In the meantime, some observers believe, the reforms must yield some economic and industrial progress in the Soviet Union and Eastern Europe, or the political survival of Gorbachev and other reformers would be endangered. □

Mexico

Chemical industry is putting more emphasis on exports

Weakening peso will make chemicals more competitive but also will increase the cost of imported feedstocks

Earl V. Anderson, C&EN New York

By most accounts, last month's precipitous plunge in the "free rate" of exchange of the Mexican peso will do little, if anything, to stymie the progress that the country's chemical industry has been making in increasing output, boosting exports, and substituting domestic production for imports.

The free-rate peso accounts for only about 20% of Mexico's foreign currency transactions, mostly those by tourists and businesses along the U.S.-Mexican border. The bulk of the country's transactions, including most exports and imports, takes place at the official "controlled" rate, which was not affected when the Bank of Mexico removed its support for the free-rate peso.

Realistically, however, some fallout is bound to hit the Mexican chemical industry. When the Bank of Mexico removed its support last month, the free rate dropped from about 1700 to the U.S. dollar to a range of 2300 to 2500. The controlled rate remained at about 1728 pesos per dollar. But analysts doubt if it can remain that much lower for long. If the controlled rate does, in fact, start declining more rapidly, Mexican products will be less expensive, hence more competitive, in world markets, particularly in the all-important U.S. market.

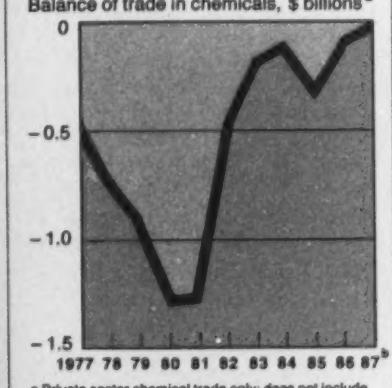
That would be good news for the Mexican chemical industry, which is pushing exports as avidly as any industry in the country (C&EN, Oct. 26, page 11). Mexico's private chemical sector exported just over $1 billion worth of chemicals last year, 35% more than in 1985. This helped reduce the private sector's chemical trade deficit to only $95.6 million, down from a hefty $342 million the year before. And Leopoldo Sanchez, president of ANIQ, Mexico's chemical industry trade association, thinks that the private sector chemical trade deficit may disappear completely this year.

For Mexico's chemical industry, however, a sharp drop in the peso's controlled rate of exchange has a dark side as well as a bright side. Many of the chemicals that private Mexican companies export are made with imported raw materials. And because Petróleos Mexicanos (Pemex), the government oil and petrochemical company, stopped importing basic petrochemicals on behalf of the private companies last year, the private companies now must do their own importing.

A weaker peso makes Mexican exports less expensive, but it will make imports more expensive. Just how much of an impact this may have on the chemical industry's export ambitions remains to be seen.

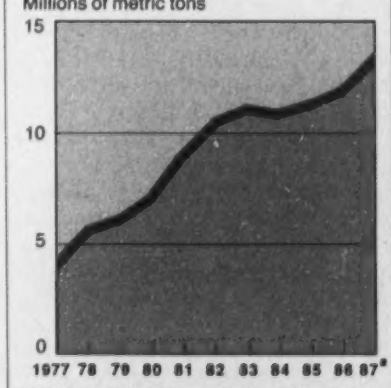
Meanwhile, Pemex is moving ahead with its petrochemical plant-building program, designed in large part to keep imported feedstock requirements to a minimum. Construction on the first phase of its huge Morelos complex is expected to be completed by the end of the year, with the plants on stream during the first quarter of 1988. This phase includes plants to produce ethylene, ethylene oxide and glycol, high-density polyethylene, and acetaldehyde. Pemex expects the entire Morelos complex to be completed by 1991, adding capacity for propylene and its derivatives, butadiene, and other petrochemicals. □

Chemical trade deficit is shrinking fast



a Private sector chemical trade only; does not include petrochemical trade of Petróleos Mexicanos (Pemex).
Source: ANIQ (Asociación Nacional de la Industria Química)

Basic petrochemical output chalks up another record



Note: Production of primary petrochemicals by Pemex only; does not include secondary petrochemicals produced by the private sector. a C&EN estimate.
Source: Petróleos Mexicanos (Pemex)